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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	CTI-103
First Inventor or Application Identifier	Dale C. McCarthy
Title	Electrical Connector Apparatus and Method
Express Mail Label No.	EK318905305US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
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Washington, DC 20231

1. [X] * Fee Transmittal Form *(e.g., PTO/SB/17)*
(Submit an original and a duplicate for fee processing)
2. [X] Specification [Total Pages 19]
(preferred arrangement set forth below)
- Descriptive title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings *(if filed)*
- Detailed Description
- Claim(s)
- Abstract of the Disclosure
3. [X] Drawing(s) *(35 U.S.C. 113)* [Total Sheets 9]
4. Oath or Declaration [Total Pages 2]
   a. [X] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. § 1.63(d))
   (for continuation/divisional with Box 16 completed)
      i. [ ] DELETION OF INVENTOR(S)
      Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

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5. [ ] Microfiche Computer Program *(Appendix)*
6. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
   a. [ ] Computer Readable Copy
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ACCOMPANYING APPLICATION PARTS

7. [ ] Assignment Papers (cover sheet & document(s))
8. [ ] 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* [X] Power of Attorney
9. [ ] English Translation Document *(if applicable)*
10. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
11. [ ] Preliminary Amendment
12. [X] Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
13. [X] * Small Entity Statement(s) *(PTO/SB/09-12)* [ ] Statement filed in prior application, Status still proper and desired
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Prior application information: Examiner _____ *Group / Art Unit:* _____
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17. CORRESPONDENCE ADDRESS

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Applicant or Patentee: Dale C. McCarthy Attorney's
Serial No.: Docket No. CTI-103
Filed: Filed March 3, 2000
For: Electrical Connector Apparatus and Method

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9 (f) and 1.27 (c)) – SMALL BUSINESS CONCERN

I hereby declare that I am

[ ] the owner of the small business concern identified below:
[X] an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN Centerpin Technology, Inc.
ADDRESS OF CONCERN 1101 Gulf Breeze Parkway, Suite 315
Gulf Breeze, FL 32561

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9 (d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business c oncern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to t he invention, entitled Electrical Connector Apparatus and Method by inventor(s) Dale C. McCarthy described in:

[X] the specification filed herewith
[ ] application serial no. , filed .
[ ] patent no. , issued .

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I acknowledge the duty to file, in this application or patent, notification of any change of status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28 (b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and be lief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeop ardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Rip Hanks
TITLE OF PERSON OTHER THAN OWNER President/CEO
ADDRESS OF PERSON SIGNING 1101 Gulf Breeze Parkway, Suite 315 Gulf Breeze, FL 32561

SIGNATURE DATE

ELECTRICAL CONNECTOR APPARATUS AND METHOD

Background of the Invention

The present invention relates to electrical connectors. In specific embodiments the invention pertains to an electrical connector for coupling to an insulated single conductor electrical cable or to a coaxial cable.

Typically, in installing single conductor cable including a central conductor with an outer insulation, the end of the wire is stripped of insulation and the bare wire is inserted into a connector where it is soldered, clamped or otherwise attached to the connector. Similarly, with coaxial cables which include a central conductor enclosed in an inner concentric insulation covered by a concentric conductive sheath and encased in an outer insulation, the common practice is to strip the outer insulation to expose the conductive sheath.

It is an object of the present invention to provide an improved electrical connector and method for mechanically coupling and for electrically coupling an insulated electrical cable to an electrical connector without the need for stripping the insulation from the cable.

Brief Summary of the Invention

The subject invention pertains to an electrical connector having a housing with a central bore for receiving an electrical cable, one or more clamping members having inwardly pointed ends in the bore and a closure member for insertion into the bore for closing the bore and for driving the pointed ends of the clamping members into mechanical connection with the electrical cable.

In application to a single conductor cable, the pointed ends of the clamping members may make mechanical connection to the cable and alternatively make electrical connection between the housing and the conductor of the cable. In application to a coaxial cable the pointed ends of the clamping members may make mechanical connection to the cable and electrical connection between the housing and the concentric sheath of the cable.

The closure member or end cap is moveable longitudinally into the bore of the housing and engages, at its outer periphery, the inner periphery of the bore. In its longitudinal movement into the bore it engages the ends of the clamping members to drive the ends radially into the electrical cable. The longitudinal movement of the end cap may be by way of threaded rational movement or by the application of a longitudinally directed force.

The electrical connector of the invention may be provided with a center pin or prong for making an electrical connection beyond the connector, and may be provided with a mounting therefor, which extends the prong into the bore of the housing to make electrical contact with the central conductor of the cable. Alternatively, the housing may include a central guide and aperture which would permit the central conductor of a cable stripped of its insulation to extend appositely beyond the bore of the housing for making electrical connection beyond the connector.

Brief Description of the Drawings

Figure 1A shows an embodiment of the subject connector for use with a single conductor insulated electrical conductor.

Figure 1B shows a specific embodiment of an electrical connector in accordance with the subject invention for use with a coaxial cable type insulated electrical conductor.

Figure 2 shows a specific embodiment of an electrical connector in accordance with the subject invention, incorporating an endcap having one or more protrusions.

Figure 3A shows an embodiment of the subject electrical connector, which incorporates a beveled ring and a compression ring.

Figure 3B shows the electrical connector of Figure 3A after insertion of the cap into the housing.

Figure 3C shows the electrical connector of Figure 3A incorporating a key and groove to prevent the beveled ring from rotating with respect to the housing.

Figure 4 shows an embodiment of the subject invention where clamping arms extend toward the end of the insulated electrical conductor.

Figure 5 shows an embodiment of the subject connector which utilizes the center conductor of the coaxial cable rather than a pin.

Figure 6 shows an embodiment of the subject connector which utilizes the center conductor of the coaxial cable rather than a pin and the inner insulation of the coaxial cable to electrical isolate the center conductor of the coaxial cable from the housing.

Figure 7 shows an end view of an electrically conductive clamp in accordance with the subject invention having eight clamping arms which have been manipulated into the clamped position.

Figure 8 shows a specific embodiment of an individual clamping arm broken away from the housing.

Figure 9A shows a side view of a conductive pin in accordance with the subject invention, incorporating a hollow portion having a single slit.

Figure 9B shows an end cross-sectional view of the hollow portion of the pin shown in Figure 9A.

Figure 10A shows a side view of a conductive pin in accordance with the subject invention, incorporating a hollow portion having two slits.

Figure 10B shows an end cross-sectional view of the hollow portion of the pin shown in Figure 10A.

Detailed Disclosure of the Invention

Referring to Figure 1, an electrical connector **100** in accordance with the subject invention is shown for use with a coaxial cable **11** having a single solid or braided conductor **12**, a concentric insulation layer **13**, a conductive sheath **14** and an outer insulation **15.** Connector **100** has a housing **25** made up of a rotatable terminal section **25A**, an interconnecting section **25B** and a housing section **25C**, which are in electrical contact with each other. Housing sections **25A**, **25B**, and **25C** can be generally cylindrical in shape and designed such that section **25B** holds section **25A** in place and makes an interference fit with

section **25C**. Section **25A** can rotate relative to sections **25B** and **25C** about the axis of the connector, which allows section **25A** to be threaded onto a counterpart connector. Alternatively, section **25A** can be fixed such that all three sections **25A**, **25B**, and **25C** form a single integral housing **25.** In this case, the section **25A** can slide onto counterpart connectors rather than being threaded.

Housing section **25C** can have a central bore **105** with an open end **107**. A conductive clamp **112** can be disposed within the bore. Conductive clamp **112** can be generally cylindrical in shape and include a collar portion **114** and one or more clamping arms **113** extending from collar portion **114**. Preferably, the outer periphery of collar portion **114** is approximately the dimension of the inner periphery of bore **105**. Collar portion **114** can support clamping arm(s) **113** in longitudinal extension toward open end **107** of bore **105.** Clamping arm **113** can have a beveled edge **115** directed radially inward and which can be contacted to urge tip **133** radially inward. The clamping arm(s) **113** can make electrically conductive contact with the housing section **25C**, for example, through collar **114**. Alternatively clamping arm(s) **113** can be made integral with electrically conductive **25C** and/or **25B**.

The opposite end of the bore **105** can be closed by a plug **218** of electrical insulating material that can be secured in the interconnecting section **25B** by a pressure fit or adhesive or other means, and has in it a central aperture **219** which communicates between the bore **105** and the open space of terminal section **25A**. In the configuration of Figure 1, an electrically conductive pin **202** can be secured in the central aperture **219** with its head portion **202A** projecting into bore **105** and its terminal portion **202B** projecting into the open space of section **25A**. The head portion **202A** may be of a split pin type as illustrated but may also be of the solid pin type such as the terminal portion **202B** as electrical connection conditions may dictate.

A closure member or end cap **200** of strong and resilient material such as plastic, nylon, rubber, brass or metal can be disposed in the open end **107** of the housing section **25C**. Cap **200** is preferably of an internal diameter to receive a cable for connection, shown to be a coaxial cable **11** in Figure 1.

Figure 1 shows cap **200** positioned just inside housing **25** where protrusion **204** on cap **200** resides in indentation **206** of housing section **25C**. The interaction of protrusion **204** and indentation **206** can hold cap **200** in position, allowing the connector to be held as a single unit prior to attachment to the end of a coaxial cable.

Accordingly, with the end of a coaxial conductor **11** inserted through cap **200** and into housing section **25**, the cable can then be pushed further into housing **25** where the hollow pin **202** penetrates the end of the coaxial cable between the center conductor **12** of the cable and insulation layer **13**, making electrical contact between the center conductor **12** and pin **202**. Cap **200** can include a beveled edge **201** the end of the cap which enters open end **107** of the housing. Beveled edge **201** can be complimentary to beveled edge **115** of the clamping arm **3**.

Once the electrical contact has been made between pin **202** and the center conductor of the coaxial cable, cap **200** can be pushed further into housing section **25C**. Pushing cap **200** into housing section **25C** can, by action of beveled edge **201** of cap **200** operating on beveled edge **115** of clamping arm(s) **113**, push clamping arm(s) **113** toward the coaxial cable causing tips **133** of clamping arms **113** to penetrate and pass through outer insulation layer **15** of coaxial cable **11** and make electrical contact with outer conductor **14** of coaxial cable **11**. As cap **200** is pushed further into housing section **25C**, protrusion **204** interacts with indentation **208** and/or protrusion **210** interacts with indentation **206.** The interaction of protrusion **210** and indentation **206** and/or protrusion **204** and indentation **208** can act to hold cap **20** securely in place inside housing **25**. Alternatively, if desired, cap **200** can be separate from the housing and slipped onto the end of the coaxial cable prior to the end of coaxial cable being inserted into housing section **25C**. Cap **200** can then be slid down the coaxial cable and pushed into housing section **25C**

Thus by cooperative action between the housing section **25**, the end cap **200** and the clamping arm(s) **113**, the cable **11** is securely attached mechanically to the connector **100** and in addition the clamping arm(s) **113** complete electrical contact between the outer conductor **14** of the cable and the housing **25** of the connector **100.** Additionally, with respect to the embodiment shown in Figure 1, electrical contact is made with the center conductor **12** and

pin **202** of connector **100** which is electrically insulated from the electrical connection made between the conductor **14** and the housing **25** of connector **100.**

Preferably, the subject connector is designed to resist the entry of moisture. For example, it is preferred to prevent moisture at the point of penetration of clamping arms **113** into the coaxial cable and at the end of the coaxial cable. Accordingly, O-ring seals **212, 214** and/or **216** can be utilized to reduce or prevent moisture at these sensitive areas.

Preferably, the tolerances of the inner diameter of housing section **25C**, the thickness of cap **200**, and the dimensions of the coaxial cable and its outer insulation are such that the penetration depth of the tip of the clamping arm **113** into the coaxial cable can be controlled. Such control of the penetration depth can be used to optimize the electrical contact between the clamping arms **113** and the housing, the impact the clamping arms have on the structure of the coaxial cable, and the friction created between the cap **200** and the coaxial cable.

Clamping arms **113** instead of being located in section **25C** prior to the insertion of the end of the insulated conductor into section **25C**, can be attached to the end of a coaxial cable prior to insertion of the end of the coaxial cable into housing section **25C**. For example, a user can align collar **114** and clamping arms **113** on the end of a coaxial cable and then press the tips **133** of clamping arms **113** into the side of the coaxial cable by hand, with pliers, or with some other mechanism. The end of the coaxial cable can then be inserted into housing section **25C** and cap **200** inserted into housing section **25C**. In this embodiment, cap **200** need not necessarily press the clamping arms **113** into the coaxial cable, but preferably reaches far enough into housing section **25C** to hold clamping arms in place with respect to the coaxial cable. In this case, the front of cap **200** need not have a beveled front edge.

In a further alternative embodiment, a tool might be used to push tips **133** of clamping arms **113** into the outer insulation of the coaxial cable prior to the insertion of cap **200** into housing section **25C**. Such a tool can slide into housing **25C** and urge clamping arms **113** into the side of the insulated electrical conductor. In this embodiment, the beveled edge of cap **200** can have a different shape, as the cap would not necessarily be responsible

for pushing the tips of clamping arm **113** into the coaxial. The cap **200** can still be useful for holding the clamping arms in position.

Figure 2 shows a variation of the connector **100** of Figure 1, wherein the conductive pin **202** is shown to have a head portion **202A** which is of the solid pin type rather than a split pin type and wherein the cap **200** is modified to include one or more slots **221** in the side wall and an inner circumferential ridge **220** spaced intermediate the ends of the slot **221.** The head portion **202A** is illustrated as a solid pin type adapted for piercing either the stranded electrical conductor **21** of a single conductor cable **20** as shown or a stranded center conductor of a coaxial cable. Head portion **202A** can also make electrical contact with a solid center conductor of a coaxial cable. The purpose of the slot **221** and ridge **220** is to provide a stress relief area around the circumference of the end cap **200.** Accordingly, when the cable **20** is in place in the connector engaging the conductive pin **202** and the cap **200** has been pushed in to seat the conductive arms **113** in the outer wall **22** of the cable, further longitudinal pressure on the end of the cap causes the side wall of the cap **200** to move inwardly along the ridge **220** thereby applying clamping pressure to outer wall **22** of the cable **20** to further mechanically secure the cable in place in the connector. The use of the slotted end cap with a single conductor cable is merely illustrative and may be used advantageously with coaxial cables.

Figure 3A is an expanded view and Figure 3B is an assembled view of another embodiment of the invention of Figure 1 which includes a double beveled ring **222** and a compression fitting ring **224** to provide additional gripping action on a cable inserted in the connector. Beveled ring **222** is positioned in the housing section **25C** such that a first beveled edge contact the beveled edge **115** of the clamping arms **113**. Compression ring **224** can then be placed into housing section **25C** such that compression ring **224** contacts the other edge of the beveled ring **222**. When cap **200** is forced into housing section **25C** it pushes compression ring **224** into beveled ring **222** which in turn forces clamping arms **113** radially inward to engage a cable inserted in the housing section. The ring **222** comes to rest and the compression ring **222**, compressed between cap **200** and beveled ring **222** is forced radially inward against the coaxial cable to further grip the coaxial cable and hold it in place.

Figure 3C is a variation of the embodiment of Figures 3A and 3B in which the end cap **200** and the housing section **25C** are threaded for rotational longitudinal movement instead of sliding longitudinal movement. In this embodiment the beveled ring **222A** is keyed with a discrete protrusion **222B** which fits into a longitudinal slot **226** in the housing **25C** to prevent rotation of the ring against the surface **115** of the clamping arm(s) **113**. In other respects the embodiment operates in the same manner as that of Figures 3A and 3B.

In the embodiment of Figure 4, the position of the conductive clamp **112** has been reversed from that shown in Figure 1 so that the clamping arms face inwardly in the bore **105**. Further, the interior of the housing section **25C** has been provided with a ramp **116** against which the beveled edge **115** of the camping arm **113** rides. The interior end of the cap **200** has been made blunt in order to engage the conductive clamp **112**. Accordingly, with a cable positioned in the connector, longitudinal movement of the cap **200** into the bore **105** forces the clamping arms **113** to ride up the ramp **116** and radially inward so that the tips **133** pierce into the cable.

Figure 5 shows an embodiment of the invention of Figure 1 wherein the center pin **202** has been removed and the cable **11** has been cut back to expose a length of the center conductor **12** adequate for projecting through the insulator plug **218** into the open portion of the terminal housing **25A**. Further, Figure 5 shows an embodiment of the invention of Figure 1 wherein the center pin **202** and the insulator plug **218** have been removed and the cable **11** has been cut back to expose a length of the center conductor **12** adequate for projecting into the open portion of the terminal housing **25A** and the insulation layer **15** and conductive sheath **14** have been cut back to expose the insulation layer **13** of sufficient length to nest in the interconnecting section **25B** and to electrically isolate the conductor **12** from the housing **25**. In all other respects the configuration of Figures 4 and 5 function in the same manner as described relative to that of Figure 1.

Figure 7 shows an end view of an embodiment having eight clamping arms **113** extending from a collar **114**, as shown in Figure 1, which have been clamped into place. Clamping of arm **113** in order to drive tip **133** into the insulation can be accomplished, for example, with a special tool for reaching into housing **25C** to urge arms **113** toward the

cable, by pushing cap **200** into housing **25C**, or by pressing arms **113** into the insulation by hand, with pliers, or with another tool prior to insertion of the end of the insulated conductor into the housing. Dashed lines **226** and **228** represents the edges of the beveled surface **115** of the clamping arms. Around the outside collar **114** can be seen through the spacings between arms **113**.

The curve of the end **133** can also be selected to optimize the performance of the connector. In Figure 7, the curve of end **133** is selected such that the eight ends form a circular pattern of deepest penetration into the conductive sheath of the coaxial cable. The dotted circle **232** in the center of Figure 6 represents the approximate location of the inner conductor of the coaxial cable. Referring to Figure 8, a single clamping arm **113** broken away from collar **114** is shown. The pointed end **133** of clamping arm **113** can have a variety of shapes, in order to optimize one or more operational characteristics of the electrical connector. In the embodiment shown in Figure 8, pointed end **133** is shaped such that as the clamping arms are manipulated to cause the piercing of the outer insulation, the sides **134** of the clamping arms come into contact with the adjacent clamping arms so as to prevent further penetration of the pointed end **133.**

Referring to Figures 9A, 9B, 10A, and 10B, specific embodiments of a pin **202** which can be utilized with respect to the electrical connectors of the subject invention is shown. For example, either pin shown in Figures 9A and 10A, or variations thereof, can be incorporated with the electrical connectors shown in Figures 1-6. Both Figures 9A and 10A show side views of pins having a hollow portion on one end for receiving an electrical conductor and a solid portion for connecting with and an external apparatus on the other end. Other pin embodiments are possible which, for example, have a solid portion at each end of the pin or have a hollow portion at each end of the pin. In addition, the entire pin can be hollow if desired. Preferably, the hollow portion of each pin can have one or more slits. The number, lengths, and widths, of the slits can vary depending on the application. Figure 9A shows a slit which extends about half the length of the hollow portion of the pin, while Figure 10A shows two slits which extend essentially the entire length of the hollow portion of the pin. Figures 9B and 10B show end views of the hollow portions of the pins shown in

Figures 9A and 10A, respectively. These slits can allow the hollow portion to expand to just the right size to receive an electrical conductor such that a good electrical contact can be made.

The present invention should not be construed as limited to the forms shown which are to be considered illustrative rather than restrictive.

Claims

1. An electrical connector for coupling to an electrical cable having a center conductor and an outer insulation layer, comprising:

a housing having an axial bore therein for receiving an electrical cable;

an electrically conductive clamp in the bore of said housing at the inner periphery thereof, said electrically conductive clamp having a pointed end shaped and sized for driving into the outer insulated layer of an electrical cable; and

a cylindrical compression cap with a closed end apertured to receive an electrical cable in passage to said housing and a side wall sized at its outer periphery for engaging the inner periphery of said housing and shaped at the open end of said side wall for engaging the pointed end of said electrically conductive clamp to drive the pointed end thereof toward the axis of the bore in said housing thereby to mechanically connect an electrical cable to said housing.

2. An electrical connector for coupling to an electrical cable of the coaxial type having a center conductor enclosed in an inner insulation layer and a conductive sheath around the inner insulation layer and an outer insulation layer overlying the conductive sheath, comprising:

a housing having an axial bore therein for receiving a coaxial cable in one end thereof, said housing being electrically conductive;

an electrically conductive clamp in the bore of said housing and electrically connected to said housing at the inner periphery thereof, said electrically conductive clamp having a pointed end shaped and sized for driving into the outer insulated layer of the coaxial cable to engage the conductive sheath thereof, and

a cylindrical compression cap having a closed end apertured to receive a coaxial cable in passage to said electrically conductive housing and having a side wall sized at its outer periphery for engaging the inner periphery of said housing and shaped at the open end of the side wall for engaging the pointed end of said electrically conductive clamp to drive the

pointed end thereof toward the axis of the bore in said housing thereby to mechanically connect a coaxial cable to said housing and to electrically connect the conductive sheath of a coaxial cable to said housing through said conductive clamp.

3. The electrical connector of claim 2 wherein the pointed end of said conductive clamp is ramp shaped and the end of the side wall of said cylindrical compression cap is complimentarily ramp shaped so that upon mutual engagement longitudinally along the axis of the said housing, the pointed end of said conductive clamp is driven radially toward the axis of said housing.

4. The electrical connector of claim 3 wherein said housing includes a radially disposed electrically insulating wall terminating the bore therein and acting as a stop for a coaxial cable received in the bore.

5. The electrical connector of claim 4 wherein said insulating wall includes a center aperture for supporting an electrical conductor insulated from said electrically conductive housing.

6. The electrical connector of claim 5 wherein the center aperture of said insulating wall is adapted to receive and support the center conductor of a coaxial cable.

7. The electrical connector of claim 5 wherein the center aperture of said insulating wall is adapted to receive and support a conductive prong projecting into the bore of said housing for making electrical contact with the center conductor of a coaxial cable.

8. The electrical connector of claim 3 wherein the inner periphery of said housing and the outer periphery of said compression cap are threaded for longitudinal axial engagement.

9. The electrical connector of claim 3 wherein the inner periphery of said housing and the outer periphery of said compression cap engage in a longitudinal axial interference fit.

10. The electrical connector of claim 9 wherein the inner periphery of said housing and the outer periphery of said compression cap are cooperatively ridged and grooved to interlock in a longitudinal axial interference fit.

11. The electrical connector of claim 10 wherein compression cap is of deformable material and the side wall of said compression cap is slotted between the point of interlock and the closed end thereof to deform radially toward the axis of the bore and to clamp on to the outer insulation layer of a coaxial cable.

12. An electrical connector for coupling to an insulated electrical conductor, comprising:

a housing having a first end for receiving an end of an insulated electrical conductor;

at least one clamping arm having a first end shaped for penetrating an outer insulation layer of the insulated electrical conductor; and

a cap for insertion into said first end of said housing after the end of the insulated electrical conductor is inserted into said first end of said housing,

wherein once said first end of said at least one clamping arm penetrates the outer insulation layer of the insulated electrical conductor and the end of the insulated electrical conductor is inserted into said first end of said housing, said cap can be inserted into said first end of said housing such that said at least one clamping arm is secured in place.

13. The electrical connector according to claim 12,

the first end of said at least one clamping arm has a beveled edge,

wherein said first end of said at least one clamping arm is caused to penetrate the outer insulation layer by a tool which pushes on the beveled edge while the end of the insulated electrical conductor is inserted into said first end of the housing.

14. The electrical connector according to claim 12,

wherein the first end of said at least one clamping arm has a beveled edge,

wherein as said cap is inserted into the first end of said housing a beveled edge of said cap pushes the beveled edge of said at least one clamping arm such as to cause the first end of said at least one clamping arm to penetrate into the outer insulation layer of the insulated conductor.

15. An electrical connector for coupling to an insulated electrical conductor, comprising:

a housing having a first end for receiving an end of an insulated electrical conductor;

at least one clamping arm having a first end shaped for penetrating an outer insulation layer of the insulated electrical conductor;

a cap for insertion into said first end of said housing after an end of the insulated electrical conductor is inserted into said first end of said housing,

wherein said at least one clamping arm is positioned within said housing such that once the end of the insulated electrical conductor is inserted into said housing, the insertion of said cap into the first end of said housing causes said first end of said at least one clamping arm to penetrate the outer insulation layer of the insulated electrical conductor.

16. The electrical connector according to claim 15,

wherein the insulated electrical conductor is of a coaxial cable type having a center conductor enclosed in an inner insulation layer and a conductive sheath around the inner insulation layer which is enclosed in an outer insulation layer,

wherein as said cap is inserted into the first end of said housing the cap causes said at least one clamping arm to penetrate through the outer insulation layer and to make electrical contact with the outer conductor of the insulated electrical conductor.

17. The electrical conductor according to claim 15,

wherein the insulated electrical conductor is of a type having a single conductor and an outer insulation layer,

wherein as said cap is inserted into the first end of said housing the cap causes said at least one clamping arm to penetrate through the outer insulation layer and to make electrical contact with a single conductor of the insulated electrical conductor.

18. The electrical connector according to claim 16,

wherein inserting said cap into the first end of said housing causes said at least one clamping arm to make electrical contact with said housing such that said housing is in electrical contact with the outer conductor of the insulated electrical conductor.

19. The electrical connector according to claim 16,

wherein said at least one clamping arm is integral with the housing.

20. The electrical connector according to claim 16,

wherein the first end of said at least one clamping arm has a beveled edge,

wherein as said cap is inserted into the first end of said housing a beveled edge of said cap pushes the beveled edge of said at least one clamping arm such as to cause the first end of said at least one clamping arm to penetrate the outer insulation layer of the insulated electrical conductor.

21. The electrical connector according to claim 16,

wherein the first end of said at least one clamping arm has a beveled edge,

wherein as the cap is inserted into the first end of said housing, the cap pushes said at least one clamping arm such that the beveled edge of said at least one clamping arm interacts with a beveled edge on the housing such as to cause the first end of said at least one clamping arm to penetrate the outer insulation layer and make electrical contact with the outer conductor of the insulated electrical conductor.

22. The electrical connector according to claim 16, wherein the cap threadably engages the first end of housing, such that the insertion of the cap is caused by threading the cap with respect to the first end of the housing.

23. The electrical connector according to claim 16, further comprising:

a beveled ring; and

a compression ring,

wherein inserting the cap into the first end of the housing causes the cap to push the compression ring such that the compression ring contacts and pushes a first beveled edge of the beveled ring such that a second beveled edge of the beveled ring engages said at least one clamping arm causing the first end of said at least one clamping arm to penetrate the outer insulation layer and make electrical contact with the outer conductor of the insulated electrical conductor.

24. The electrical connector according to claim 23, wherein the housing has a groove adapted to receive a discrete protrusion on the beveled ring, wherein the discrete protrusion is guided by the groove as the beveled ring is pushed by the compression ring, and wherein the discrete protrusion and groove prevent the beveled ring from rotating with respect to the housing.

25. The electrical connector according to claim 16,

wherein said housing is adapted to receive the end of the insulated electrical conductor which has a portion of the inner insulation layer and center conductor protruding from an otherwise flush end of the insulated electrical conductor,

wherein the portion of the center conductor protrudes from the protruding portion of the inner insulation layer such that the protruding portion of the inner insulation layer acts to electrically insulate the center conductor from the housing and the protruding center conductor protrudes into a second end of the connector.

26. The electrical connector according to claim 16, further comprising:

an insulation section attached to the housing,

wherein the insulation section has an aperture for receiving a protruding center conductor of the insulated electrical conductor, where said housing and insulation section is adapted to receive the end of the insulated electrical conductor which has a portion of the center conductor protruding from an otherwise flush end of the insulated electrical conductor such that the protruding center conductor passes through the aperture in the insulation section and protrudes into a second end of the connector, and where the insulation section electrically insulates the center conductor from the housing.

27. The electrical connector according to claim 16, further comprising:

an insulation section having an aperture therethrough, and an electrically conductive pin located in the aperture of the insulation section such that the pin protrudes into the first end of the connector and protrudes into a second end of the connector,

wherein the center conductor of the insulated electrical conductor makes electrical contact with the pin protruding into the first end of the connector as the end of the insulated electrical conductor is inserted into the first end of the connector.

28. The electrical connector according to claim 27,

wherein the pin has a hollow portion protruding into the first end of the connector for receiving a solid center conductor.

29. The electrical connector according to claim 28, wherein the hollow portion of the pin has at least one slit allowing the hollow portion to expand as a solid center conductor enters the hollow portion.

30. The electrical connector according to claim 27,

wherein the pin has a solid portion protruding into the first end of the connector for contacting the center conductor of the insulated electrical conductor.

31. The electrical connector according to claim 16,

wherein the cap comprises at least one protrusion which provides strain relief when the cap is inserted into the first end of the connector while the end of the insulated electrical connector is inserted in the first end of the connector.

32. The electrical connector according to claim 31,

wherein the cap comprises at least one slot which allows the cap to compress when inserting the cap into the first end of the housing.

Abstract of Disclosure

The subject invention relates to an electrical connector for coupling to an insulated single conductor electrical cable or to a coaxial cable, the latter being of the type having an inner conductor enclosed in an inner concentric insulation and having a generally concentric conductive sheath therearound and an outer insulation enclosing the conductive sheath. The subject connector includes a housing having an electrically conductive portion and a bore therein. One or more conductive arms can be disposed in the bore and electrically connected to the conductive housing portion and have pointed ends sized for piercing the outer insulation of the insulated electrical conductor. A closure member is included for closing the open end of the above and for forcing and/or securing engagement of the pointed ends of the conductive arms through the outer insulation of an electrical cable. For embodiments for use with a coaxial cable, the conductive arms are insulated from the electrical conductive pin and the pointed ends of the conductive arms can be shaped relative to one another to pierce the outer insulation and the conductive sheath of the cable without contacting the center conductor.

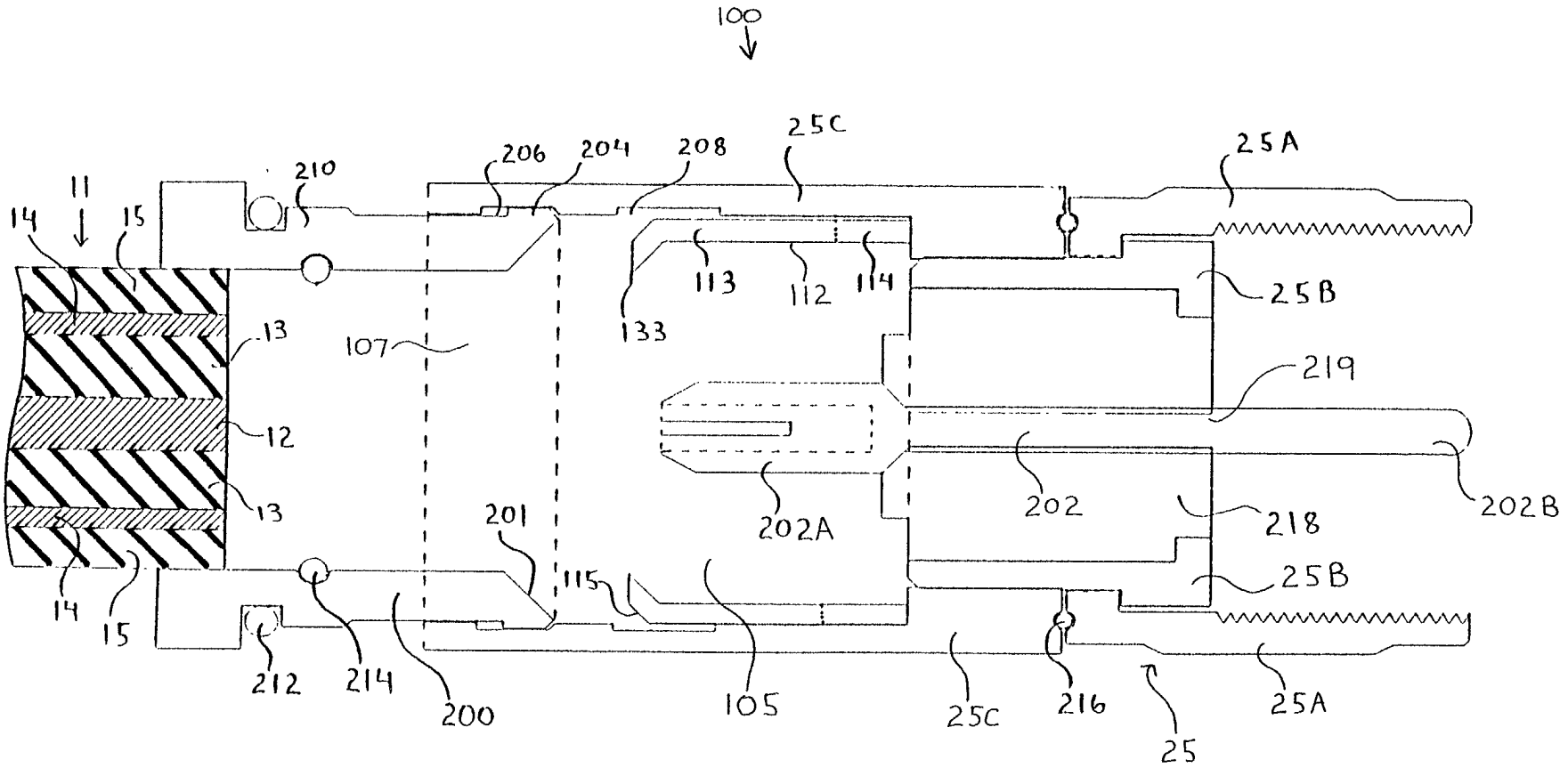

FIG. 1

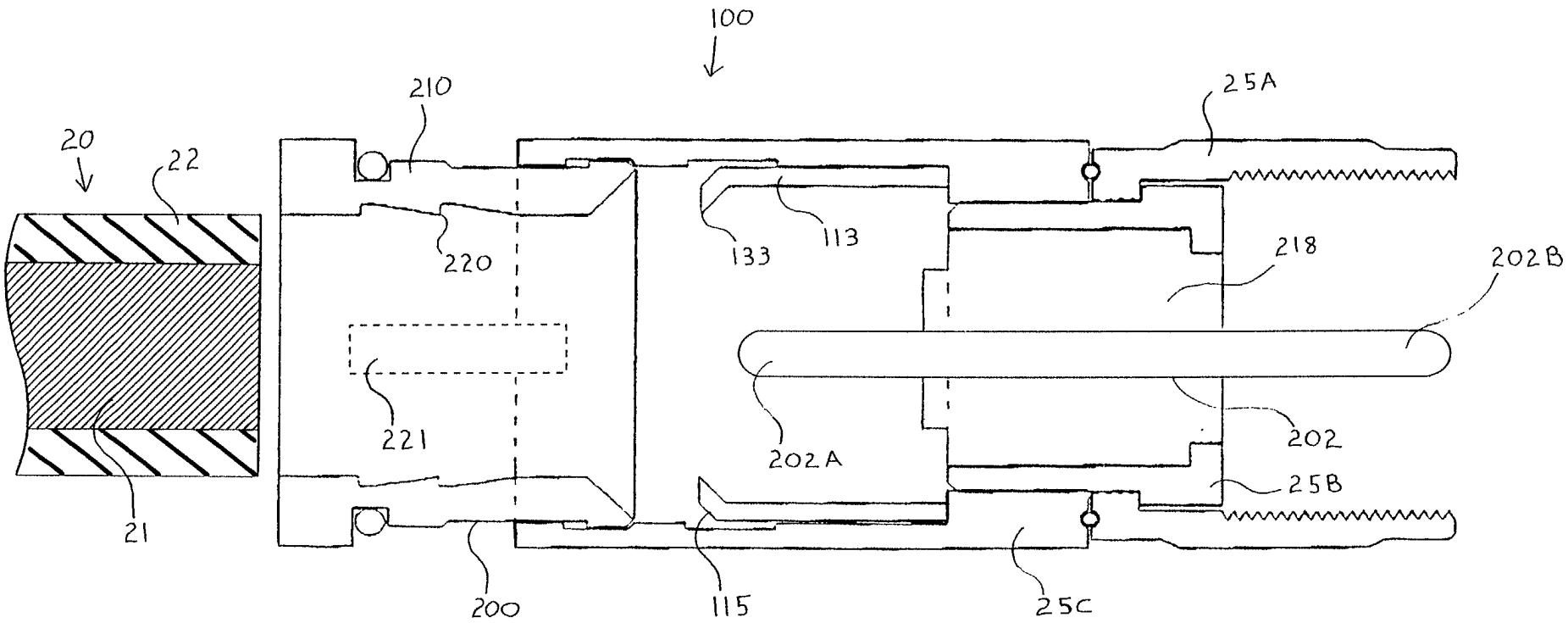

FIG. 2

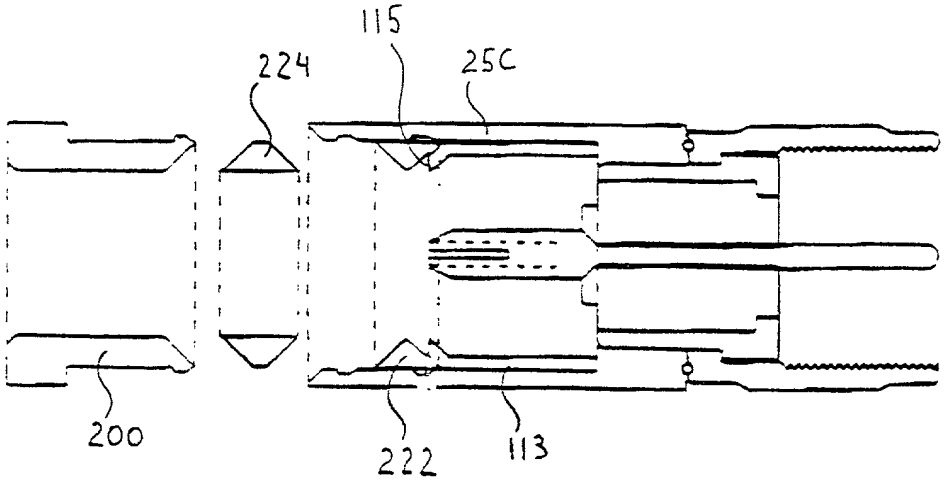

FIG. 3A

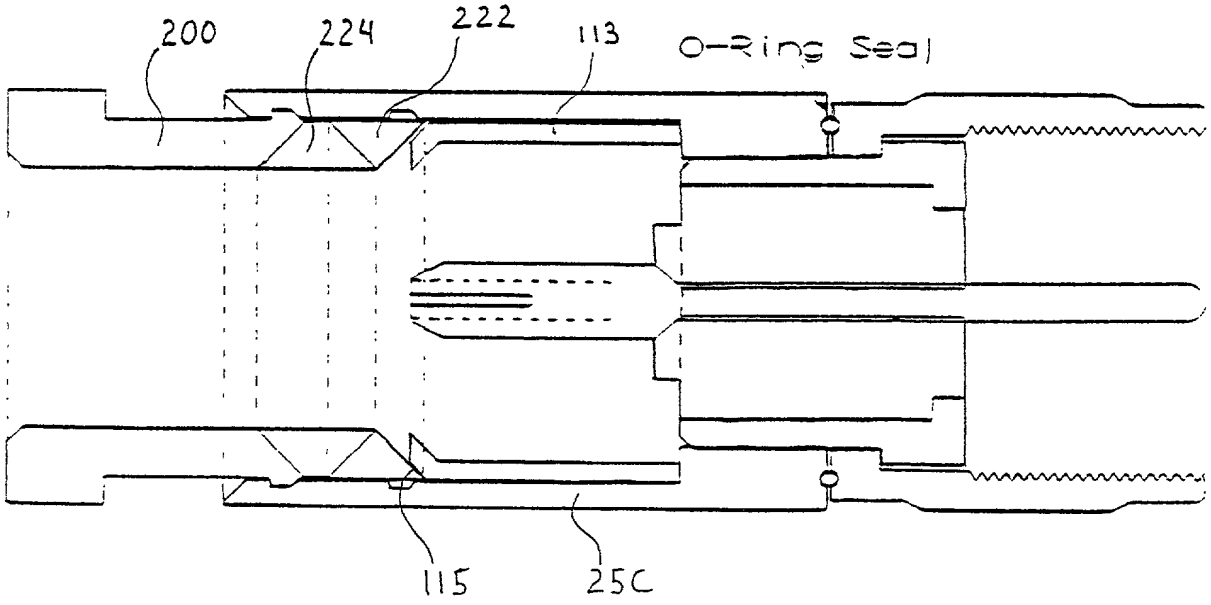

FIG. 3B

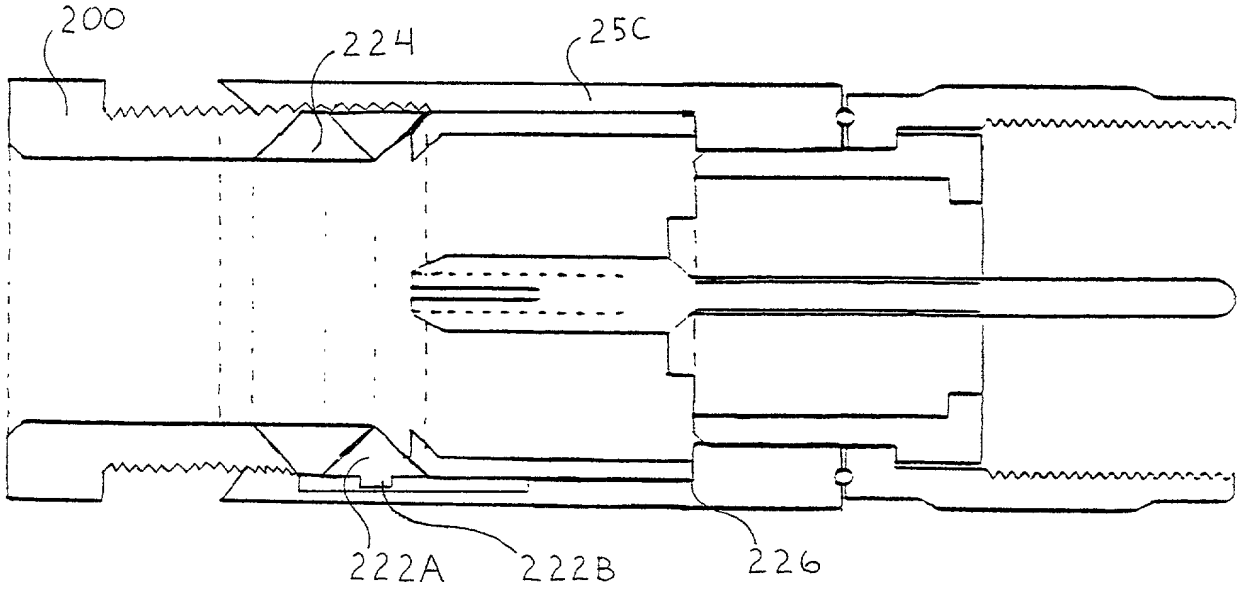

FIG. 3C

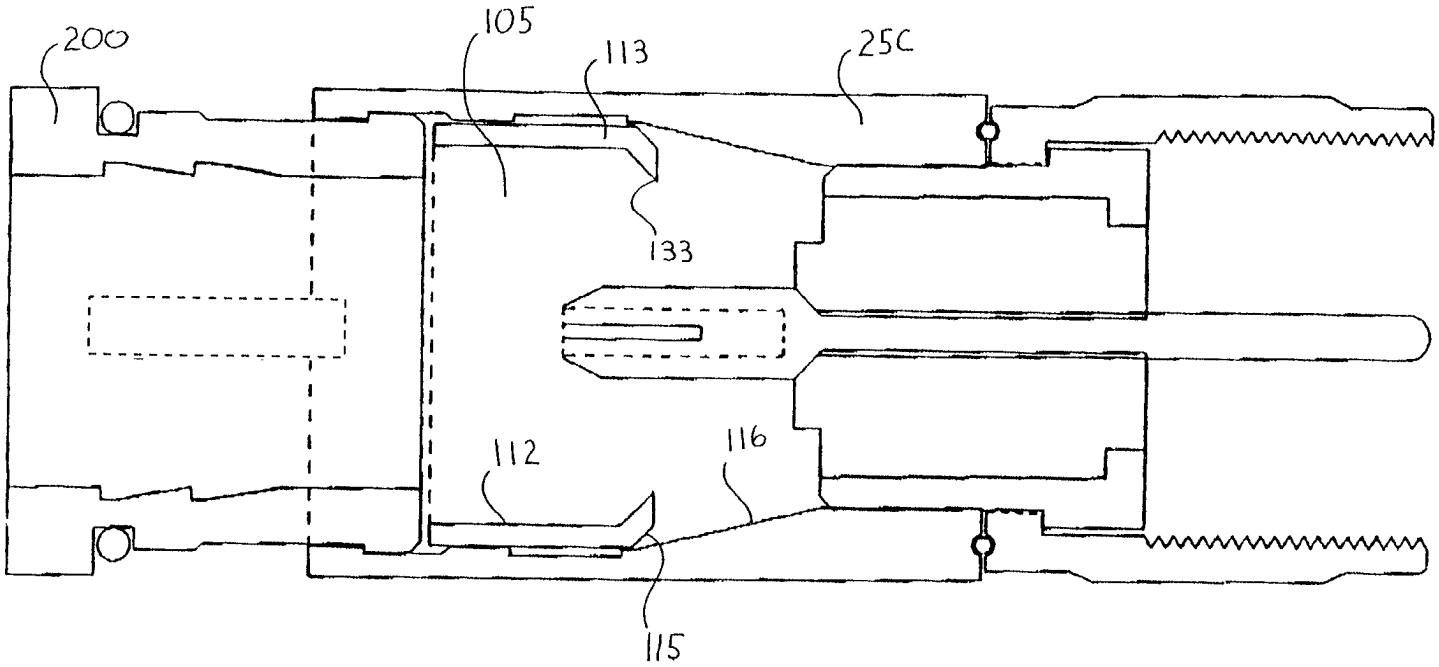

FIG. 4

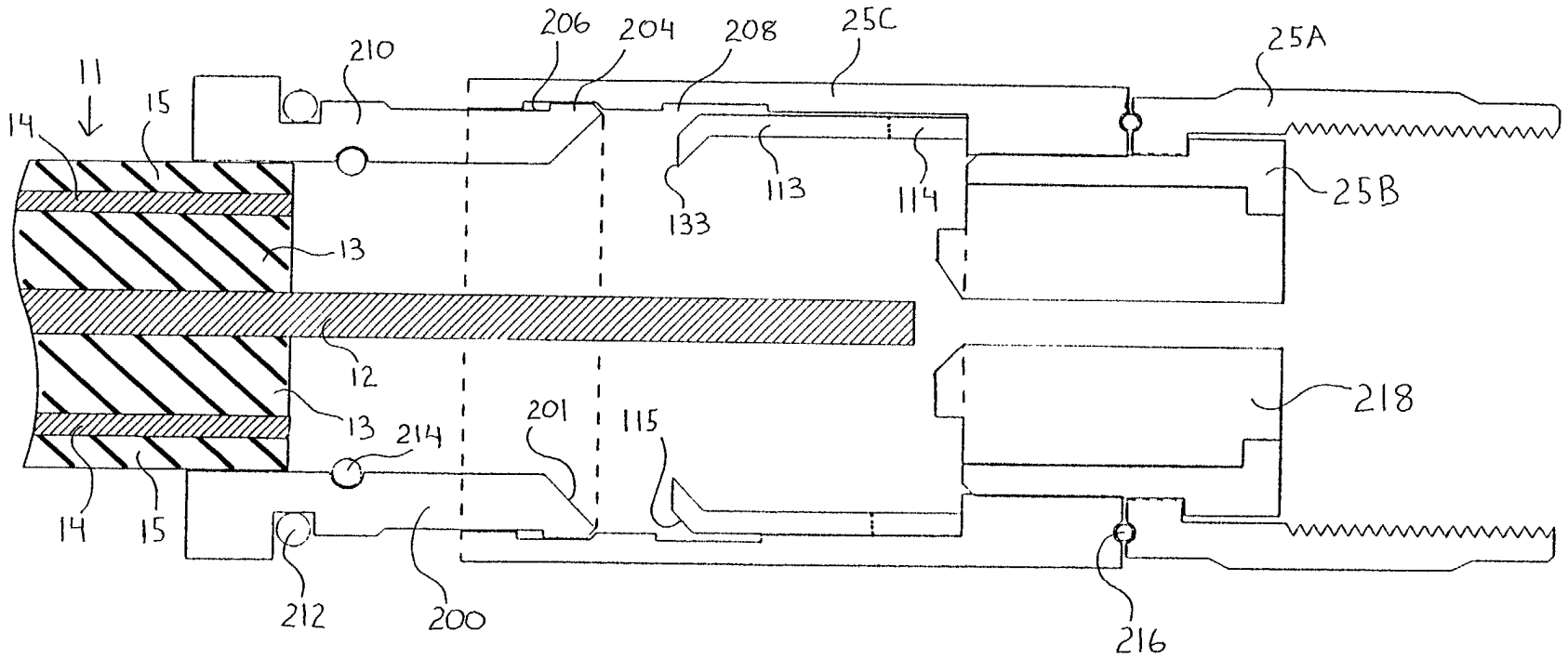
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FIG. 5

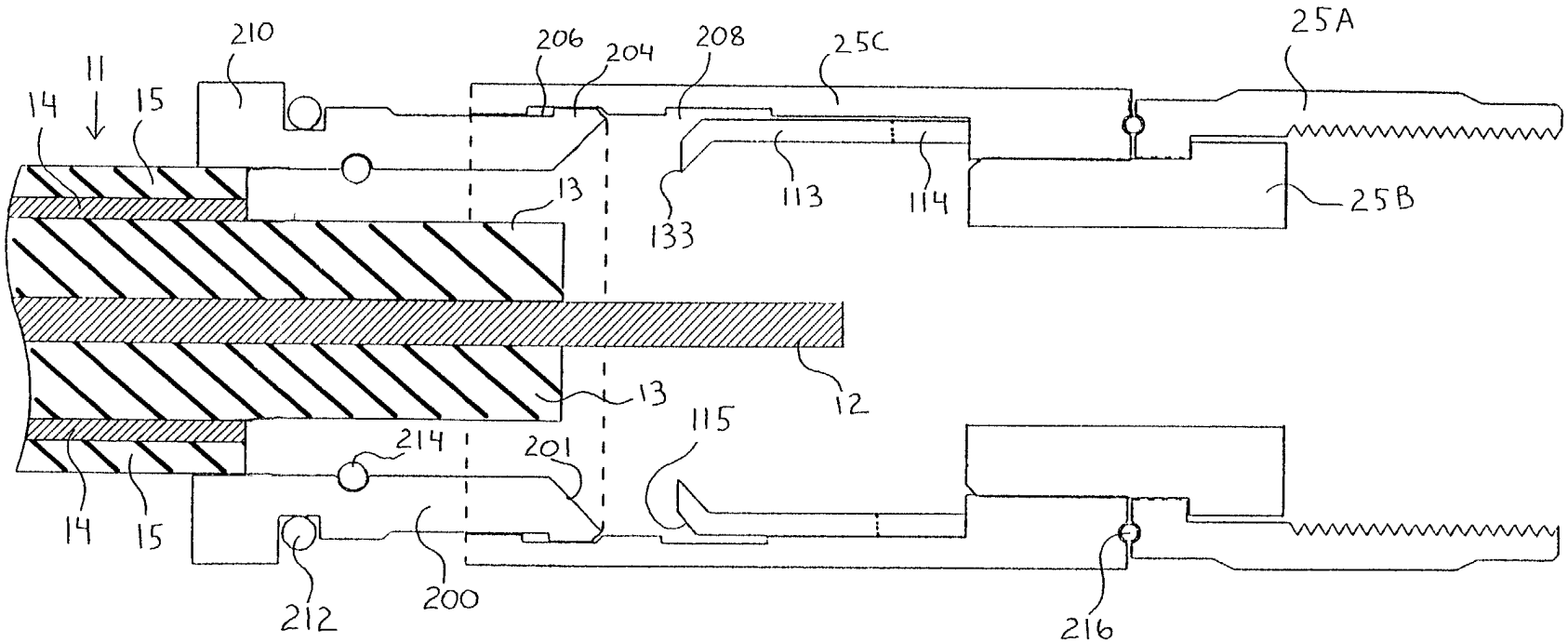

FIG. 6

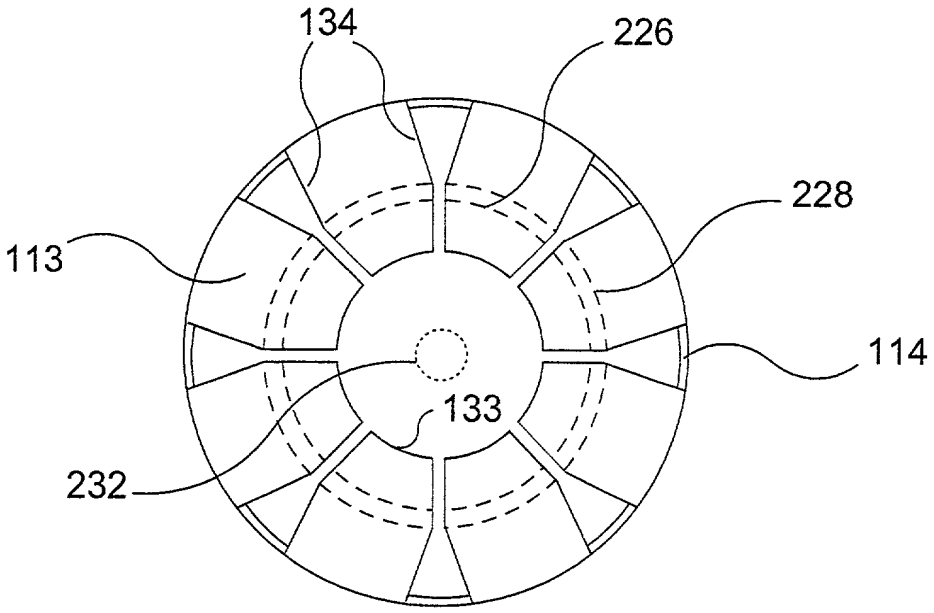

FIG. 7

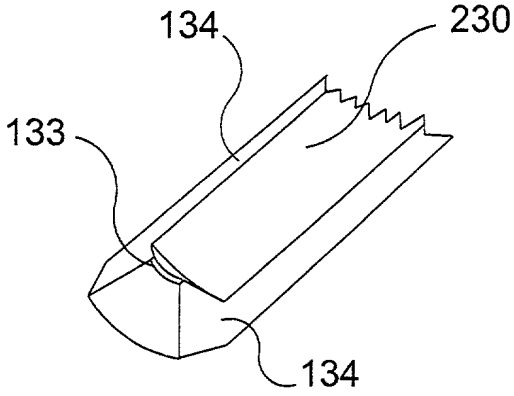

FIG. 8

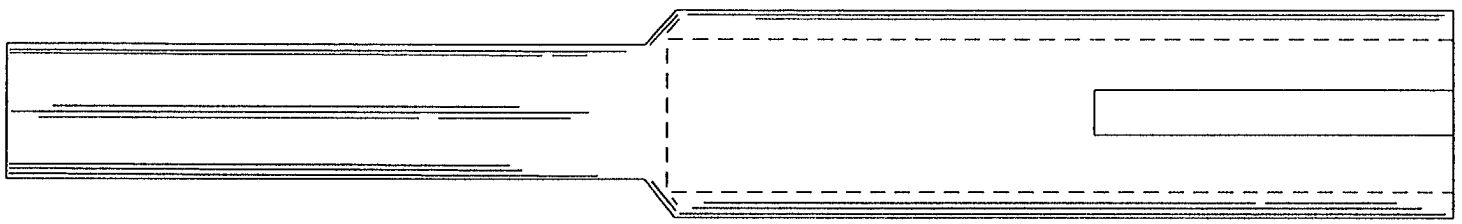

FIG. 9A

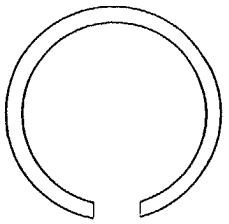

FIG. 9B

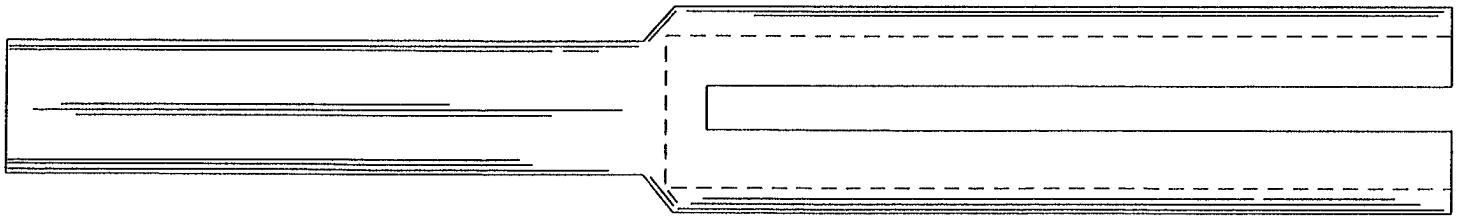

FIG. 10A

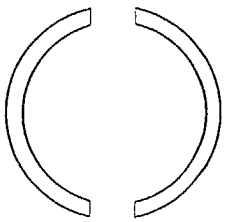

FIG. 10B

DECLARATION (37 CFR 1.63) AND POWER OF ATTORNEY

As a below-named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name; and

I believe that I am the original, first, and sole inventor (if only one name is listed below), or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **Electrical Connector Apparatus and Method**, specification for which

☐ is attached hereto.

☐ was filed _____, Serial No. _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code §119 and/or §365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Application Serial No.	Country	Filing Date	Priority Claimed

I hereby claim priority benefits under Title 35, United States Code §119 of any provisional application(s) for patent listed below:

Application Serial No.	Filing Date	Priority Claimed

I hereby claim the benefit under Title 35, United States Code, §120 and/or §365 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Application Serial No.	Filing Date	Status (Patented, Pending, Abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following persons registered to practice before the Patent and Trademark Office as my attorneys with full power of substitution and revocation to prosecute this application and all divisions and continuations thereof and to transact all business in the Patent and Trademark Office connected therewith: David R. Saliwanchik, Reg. No. 31,794; Jeff Lloyd, Reg. No. 35,589; Doran R. Pace, Reg. No. 38,261; Christine Q. McLeod, Reg. No. 36,213; Jay M. Sanders, Reg. No. 39,355; James S. Parker, Reg. No. 40,119; Frank C. Eisenschenk, Reg. No. 45,332; Jean Kyle, Reg. No. 36,987; Seth M. Blum, Reg. No. P-45,489.

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352-375-8100

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Pensacola, FL 32505

_____ Date _____

Signature of First or Sole Inventor

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Name of Second Joint Inventor _____

Residence _____ Citizenship _____

Post Office Address _____

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_____ Date _____

Signature of Second Joint Inventor

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Name of Third Joint Inventor _____

Residence _____ Citizenship _____

Post Office Address _____

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_____ Date _____

Signature of Third Joint Inventor

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